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Abstract

How central banks can best communicate to the market is an increasingly important topic in the central banking literature. With ever greater frequency, central banks communicate to the market through the forecasts of prices and output with the purposes of reducing uncertainty; at the same time, central banks generally rely on a publicly stated medium-term inflation target to help anchor expectations. This paper aims to document how much the release of the forecasts of one major central bank, the Bank of Japan (BOJ), has influenced private sector expectations of inflation, and whether the degree of influence depends to any degree on the adoption of an inflation target (IT). Consistent with earlier studies, we find the central bank's forecasts to be quite influential on private sector forecasts. In the case of next year forecasts, their impact continues into the IT regime. Thus, the difficulties of aiming at an inflation target from below do not necessarily diminish the influence of the central bank's inflation forecasts.

Keywords: central bank communication, Bank of Japan, inflation forecast, inflation targeting.
JEL classification: E31, E52, E58

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1. Introduction

How central banks should best communicate to the market is an increasingly important topic in the central banking literature. With ever greater frequency, central banks communicate to the market through forecasts of prices and output over both the near and medium-term. These forecasts can serve the purpose of reducing errors and uncertainty by private forecasters, both with regard to economic fundamentals as well as the future policy actions of the central bank. In so doing, they can improve the effectiveness of other central bank communications and policies as well as economic welfare more generally. This paper aims to contribute to the literature on central bank forecasts, by documenting how much the release of the forecasts of one major central bank – the Bank of Japan (BOJ) – has been influencing private sector expectations of inflation.

At the same time, central banks of the 21st century generally rely on a publically stated medium-term inflation target to help anchor expectations of inflation. Inflation targeting (IT) removes uncertainty about at least one of the ultimate objectives of the central bank, however much macroeconomic and global shocks may influence near-term inflation outcomes. The Bank of Japan adopted inflation targeting in early 2013, relatively late in the community of central banks in advanced economies, and more than a decade after they began to release economic forecasts. This paper also aims to examine whether the impact of Bank of Japan forecasts on those of the private sector has been influenced by the adoption of an inflation target.

In contrast to most other advanced economies' experiences with inflation targeting, where IT was introduced in an effort to bring overly high inflation down and stabilise it at low levels, the Bank of Japan moved to IT when existing inflation (and indeed the inflation of the previous 15 years) was below the new target. In cross-country work, Ehrmann (2015) suggests that central bank may have more difficulty in hitting newly adopted inflation targets from below than from above, as inflation expectations in such cases can be sticky in

response to positive inflation surprises. The data set of Ehrmann's paper ends too quickly to lend insight into Japan's experience however.

While there is a large literature on the effectiveness of inflation forecasts, as well as one on the effectiveness of IT targeting frameworks for monetary policy, our paper is the first, to our knowledge, that directly examines how the influence of inflation forecasts by the central bank might be impacted by the introduction of an inflation targeting regime, especially in the environment of lower inflation rates than the newly introduced target rate. At the same time, Japan's below target inflation can no longer be viewed as unusual, as inflation levels in advanced as well as many emerging economies are persistently weak and below established goals. For countries that may be considering introducing an inflation targeting regime in the midst of a wave of disinflationary pressure, the experience of Japan may be worth examination.

To preview our results, the estimations that follow, consistent with earlier findings, suggest that Bank of Japan forecasts significantly influence private sector forecasts. Upon the introduction of the inflation targeting regime, preliminary estimates of the influence of the Bank of Japan forecasts were lowered. However, in the case of next year forecasts that serve as a better proxy for medium to long-term inflation expectations, a primary concern for the central bank, the estimate of diminished influence are not statistically significant when the confounding impact of the Lehman failure in 2008 is accounted for. At the same time, the differences in measures of the forecast accuracy of BOJ and private sectors are not statistically significant, which is consistent with central bank forecasts playing more of a complementary role than a dominant role in shaping inflationary expectations.

The rest of the paper will proceed as follows. In the next section, we review the literature on central bank communication, with a particular focus on central bank forecasts, as well as the introduction of inflation targeting regimes. In section 3, we discuss the data and institutional background, as well as outline the empirical strategy behind the tests for the effectiveness of central bank forecasts. Sections 4 to 7 present the main results, tests of forecast accuracy, event study evidence and an array of robustness checks; Section 8 concludes.

2. Review of the Literature

Much of the early literature on the impact on central bank communications focused on their impact on market volatility. The relationship between central bank communications and interest rate volatility was examined by Gropp and Kadarejia (2006), Andersson (2007) and in a series of papers by Ehrmann and Fratzcher (2007a, b). A few years on, Nakajima and Hattori (2010) found that the release of the Bank of Japan outlook report and minutes indeed reduced the volatility of interest rates, in contrast to the volatility increasing impact of a change of policy as well as an increase in opposition votes in policy board meetings. Speeches and press conferences have differing effects; but after the introduction of the zero interest rate policy (ZIRP) and quantitative easing in Japan, the authors show that the impact of information transmission on interest rate volatility declined significantly.

An increasingly important strand of the literature focuses on how central bank communication affects private sector forecasts of inflation. Given that measures of private sector expectations of inflation are important in the estimation of ex ante real interest rates and Philips curves, how central bank communication can influence these expectations is of considerable interest to policymakers. Romer and Romer (2000) show that the Federal Reserve had, at least during their period of investigation, superior information to the private sector when it came to inflation forecasts, and the private sector indirectly inferred this information from the policy changes undertaken by the Federal Reserve. A number of other papers have since shown that the release of information by the central bank can increase the predictive precision of private interest rate forecasts.

An early look at the influence of the publication of the central bank's own inflation forecasts in clarifying future economic developments was provided by Fujiwara (2005). Examining the case of Japan, where central bank forecasts for inflation and GDP began to be published from October 2000, Fujiwara shows that the introduction of Bank of Japan forecasts for economic variables decreased the dispersion of private sector forecasts, which can be interpreted as decreasing uncertainty about the economy. Later, Ehrmann et al. (2012) tested, but did not find, that measures of central bank transparency for 12 advanced economies – including the provision of central bank forecasts – reduced the disagreement among private sector forecasts for inflation. On the other hand, Hubert (2014) found that central bank forecasts in the case of the US did become a focal point for private sector expectations.

The more recent strands of the literature relate to the impact of central bank forecasts on the actual level of private sector inflation expectations. Pedersen (2015) shows that the short-run inflation forecasts of the private sector are influenced by the forecasts published by the central bank in the case of Chile, particularly when the central bank forecasts are higher than the private sector forecasts.

Hubert's (2015) study of five countries – Canada, Japan, Sweden, Switzerland and the United Kingdom - finds that central bank inflation forecasts indeed influence the level of private forecasts in all cases. Meanwhile, Hubert also documents that with the exception of Sweden's Riksbank, the relative forecast accuracy of the central banks was not greater than that of private agents. Thus the influence of the central banks was due to the complementary of its information set relative to that of the private sector's for forecasting purposes. This complementarity could either reflect differences in the model for the determinants of inflation, or inside information about the future direction of policy.

The literature on the impact of the central bank inflation forecasts differs somewhat from the literature on the introduction of inflation targeting. For inflation targeters, the introduction of inflation targeting has been shown to reduce the dispersion of inflation forecasts generally (Crowe, 2010), but this does not apply when only developed countries are examined (Cecchetti and Hakkio (2009), Capistran and Ramos-Francia (2010)). Likely reasons for this finding include the pre-existing relative stability of inflation in developed countries, an already homogenous view about future developments, which would mean that an inflation target may have, as Capistran and Ramos-Francia (2010) put it, "formalized an implicit target that was already maintaining a relatively low dispersion of inflation expectations".

Though the impact of central bank inflation targeting, and central bank inflation forecasts on private sector forecasts have both been examined in detail, how the two might interact has not. The one limited exception is Pedersen (2015), who includes as a variable in his study of inflationary expectations in Chile the difference between two-year inflation expectations and the formal target as a measure of credibility of the central bank. In this case, when private forecasters believe that inflation will be over (under) the central bank's target in the medium and long-term, their short-run inflation forecasts are then higher (lower) than otherwise. However, as an inflation target is in place throughout the period, he

is unable to assess whether the existence of the target itself affects the influence of central bank forecasts.

Inflation targeting regimes became widespread in an era when countries viewed them as a tool to rein in high inflation by anchoring expectations at the target. However, more recently weak inflation has meant that inflation has been persistently below levels considered optimal across a wide range of countries, not least the United States. A recent work by Ehrmann (2015) suggests that at low levels of inflation, inflationary expectations are less likely to be anchored by a target, and are more sensitive to lower-than-expected inflation shocks than higher-than-expected inflation shocks. The author concludes there may be unique difficulties in managing inflationary expectations when the central bank is targeting inflation from below, perhaps due to the difficulties of operating monetary policy at the zero lower bound.

In sum, the literature, despite clarifying in many respects the impact of central bank public forecasts on private forecasts, and the impact of the adoption of inflation targeting on expectations formation more generally, still has open questions with regard to the interaction of the central bank's published forecasts with those of the private sector, and the influence of an inflation target. Our paper, by focusing on the case of the Bank of Japan, which has provided inflation forecasts for more than 15 years, and recently introduced an inflation targeting regime, is well placed to shed light on the issue.

3. Data and Empirical Strategy

3.1 Data

Private sector forecasts. The main objective of the empirical analysis is to assess the impact of the forecasts of the Bank of Japan on private sector inflationary expectations. As the main proxy measure of private inflationary expectations, we take the inflation forecasts from the so-called ESP survey of professional forecasters surveyed by the Japan Center for Economic

Research (JCER). The survey started in 2004.[1] Around 40 economists and market analysts from the private sector and independent research institutes are asked their forecasts for the change in annual average level of consumer price index (CPI) excluding fresh food ("core inflation") over the current and next fiscal years (from April to March of the following calendar year) along with other major macroeconomic variables. Private forecasters are surveyed monthly, with the survey period spanning across the last few days of a month and the first few days of the following month, and the average of the forecasts is published about a week after the close of the survey. For the purposes of this study, medians have also been made available to us. We focus on the median of these forecasts as the principal summary statistic: the choice is based on the fact that the Bank of Japan forecasts are also summarized by the median of forecasts of policy board members. Medians are also less susceptible to the influence of outlier forecasts.

Bank of Japan inflation forecasts. As mentioned above, our objective is to analyse the effect of the inflation forecasts of Japan's central bank, the BOJ, on inflationary expectations of the private sector. In October 2000, the BOJ began to publish summary statistics of the internal forecasts made by individual members of its policy board for inflation, or the change in annual average level of consumer price index (CPI) excluding fresh food ("core inflation") over the current fiscal year (from April to March of the following calendar year). In 2001, the bank also began to release next fiscal year forecasts.[2] Initially the Bank of Japan only announced ranges of forecasts, but from 2003 also included the medians of these forecasts. For the purposes of this paper, we focus on the median of the inflation forecasts of the Policy Board.

The frequency with which the forecasts have been provided has changed over time. Next year fiscal forecasts were first published annually, and then starting in 2005 on a semi-annual basis every April and October. From mid-2008, the forecasts were released in January and July as well, thus increasing the frequency to a quarterly basis. We have

[1] The ESP forecasts were originally collected by the Economic Planning Association, an organization affiliated with the Cabinet Office, which published a periodic journal "Economy, Society, Policy" (which is where the acronym "ESP" came from). In April 2012, the Japan Center for Economic Research (JCER) took over the survey. Forecasts for a number of economic variables such as GDP growth are also surveyed and published.

[2] The BOJ also publishes GDP forecasts; more recently, the announced forecasts of GDP and inflation are inclusive of one additional year, ie the fiscal year after the subsequent one.

collected the historical figures from a number of BOJ publications, including the "Outlook for Economic Activity and Prices" and "Statement on Monetary Policy".

The focus of this paper is on the impact of next-year forecasts—in particular, how changes in BOJ forecasts for the next fiscal year influence the private sector's forecasts for the same periods.[3] We also examine current year forecasts, but to the extent that the current year forecast is subject to actual data, inflation expectations are arguably better gauged by the next year forecasts than the current year forecasts. Further, central banks usually are concerned with medium to long-term inflation expectations, for which the next year forecasts serve as a better proxy. The features of the BOJ and the forecasts from the JCER survey are summarised in Table 1.

Control variables. We include control variables in regression analyses that, in addition to the Bank of Japan forecasts, should also shape private sector inflation expectations. Thus, when assessing the impact of BOJ forecasts, particularly during the window during which new Bank of Japan forecasts were announced, it is important to control for important changes to macroeconomic and financial market conditions that might affect inflationary expectations.

The main control variables that we include in this study are:

Inflation "surprises" from the monthly CPI releases ($InfSurp_t$). An inflation surprise is defined as the currently realised year-on-year quarterly core inflation minus the latest median inflation forecast for that quarter from the ESP survey. Realised quarterly core inflation is calculated as the year-on-year change in the average core CPI level for the months of that quarter. When the core CPI level is only available for the first or first two months of a quarter, realised inflation is the year-on-year change in the average core CPI level for which realised data are available. A positive surprise may lead the private sector to upgrade its inflation outlook. Pedersen (2015) shows that surprises in monthly released data affect current-year inflation expectations of private forecasters but not their next-year inflation expectations.

Changes in the expected yen exchange rate ($\Delta e^{esp}_{t,cy}$ and $\Delta e^{esp}_{t,ny}$, cy for current year and ny for next year). We measure the log change in the expected yen-dollar rate between two consecutive ESP surveys for both the current and next fiscal years. Expected depreciation of

[3] Two-year ahead inflation forecasts have been provided by the JCER from July 2013 and by the BOJ since October 2008, but are not used in this study due to the limited sample size.

the Japanese yen might exert some upward pressure on inflation in Japan via exchange rate pass-through, appreciation could work in the opposite direction. Hara et al. (2015) suggest that exchange rate pass-through to Japan's consumer price index has been increasing since the late 2000s.

Changes in the spot oil prices (Δoil_t^{spot}) *and average futures oil prices for the current or next fiscal year* (Δoil_t^{cy} and Δoil_t^{ny})*.* We measure the log changes in the spot prices as well as in the average prices of future contracts with delivery in the current or next fiscal years for West Texas Intermediate (WTI) crude oil.[4] Both the inflation forecasts made by the BOJ and by the private sector incorporate expected movements in energy prices. Changes in spot oil prices, as well as changes in oil price expectations, as reflected in futures prices, could shape the private sector's inflationary expectations.

We also include the lag of the change in inflationary expectations to control for persistence in the movement of inflationary expectations.

The full description of variables is included in Table A1 in the appendix.

The introduction of inflation targeting. The full sample goes from 2004 (when the ESP survey began) to end-2015; the BOJ's adoption of inflation targeting covers only the final part of the full sample period. In January 2013, the BOJ set an inflation target of two percent, and within a few months had introduced a regime of quantitative and qualitative easing measures (QQE) with the explicit objective of achieving that target in two years.[5] By including interactive dummies, our empirical model will take into account the adoption of inflation targeting policy during the sample period, with a view towards shedding light on the effect it may have had on the causal relationship between central bank and private sector forecasts.

[4] See Appendix Table A1 for details on how the average prices are calculated.

[5] Since March 2006, the Bank had adopted a numerical reference (one percent CPI inflation) as "understanding of price stability"; in February 2012, the Bank had switched that understanding to "inflation goal"; in January 2013, to "inflation target"; and the explicit time commitment of 2 years was only announced in April 2013. See Appendix I of Nishizaki et al. (2014) for changes in exact wordings of these numerical reference points. We check in a later section whether broadening or narrowing the definition of regime change to occur around these dates makes a difference to the results.

The Lehman default shock. While we include many variables in the specification, we do not want to rule out the possibility that during certain extreme events, changed forecasts by the Bank of Japan and private sector forecasts may show some spurious relationship due to factors outside the model. One plausible example of this is the Lehman default of September 2008, after which business and consumer sentiment all plunged dramatically. For this reason for both next and current year forecasts, we also estimate our best models for samples that exclude the first observation right after the Lehman shock. (In other specifications, we keep the observation but instead include a dummy for the Lehmann shock as an explanatory variable).

3.2 Empirical Strategy

The empirical approach is as follows. First, we match each publication of BOJ forecasts with two sets of ESP forecasts: one that comes from the survey date right before the release date of the BOJ forecast and one that comes from the survey date right after the release of BOJ forecast. The matching procedure for two successive dates is illustrated in Graph 1. The result is 38 pairs of forecast surveys matched with 38 releases of BOJ forecasts between 2004 and 2015 (for both next and current-year forecasts). For both the ESP and BOJ forecasts, the median is the statistic used.

We take the change in the median of ESP forecasts, for the next fiscal year $\Delta\pi^{esp}_{t,ny}$ between the two surveys around each Bank of Japan forecast, as the dependent variable in our main regression model. The main explanatory variable is the difference between the median of the BOJ forecasts and the ESP forecasts in the survey right before the release of the BOJ forecasts ($\pi^{boj}_{t-1,ny} - \pi^{esp}_{t-1,ny}$). Using this explanatory variable in a regression allows us to assess the degree to which private analysts adjust their expectations in response to the deviation of the BOJ forecasts from their own forecasts. If the degree of adjustment is significant, even after controlling for other factors, then this is consistent with the hypothesis that the private sector believes that the BOJ forecasts contain some valuable information about the economy beyond changes to the private sector's existing information set (as captured by the control variables in Graph 1).

We examine the bilateral relation (without controlling for other factors) between the difference of the BOJ and the (previous) ESP forecasts (horizontal axis) and the change in the ESP forecasts (vertical axis) in Graph 2. We do this for next year forecasts in the left-hand panel and current year forecasts in the right-hand panel. Indeed, a positive relation is apparent for both next-year and current-year forecasts, which suggests that private forecasters may indeed have changed their forecasts in response to the newly released BOJ forecasts. Of course, this relationship needs to be examined more carefully in the multivariate regression model to follow, which controls for other determinants of inflation expectations.

4. Regression analysis

As noted above, the principal regression equation takes as the dependent variable the change in the median of ESP inflation forecasts for the next fiscal year $\Delta\pi^{esp}_{t,ny}$ around each Bank of Japan forecast. For the explanatory variables, the key explanatory variable of interest is the difference between BOJ median forecast for the next year and the median ESP forecast, or ($\pi^{boj}_{t-1,ny} - \pi^{esp}_{t-1,ny}$). As previously mentioned, we also include a number of control variables for changes in the economy and financial markets during the relevant window: inflation "surprises"; changes in the expected yen exchange rate; and changes in oil prices, both spot and future. We also control for persistence in changes in inflation expectations by including a lagged term.[6]

$$\Delta\pi^{esp}_{t,ny} = Constant + \beta_1\Delta\pi^{esp}_{t-1,ny} + \beta_2 InfSurp_t + \beta_3\Delta e^{esp}_{t,ny} + \beta_4\Delta oil^{ny}_t \left(or\ \Delta oil^{spot}_t\right) +$$

$$+\beta_5\left(\pi^{boj}_{t-1,ny} - \pi^{esp}_{t-1,ny}\right) + u_{t.}$$

The estimation results for next year forecasts are reported in Table 2. We first report models for inflationary expectations without considering BOJ forecasts. The change in oil prices – whether via the spot (column (1)) or forecast channel (column (2)) – has the right

[6] The formula looks like an error correction model in which there exists a long-run cointegrated relationship between the BOJ and the ESP forecasts and their deviation ($\pi^{boj}_{t-1,ny} - \pi^{esp}_{t-1,ny}$) is corrected by the following ESP forecast $\Delta\pi^{esp}_{t,ny}$ controlling other short-term dynamics. However, we hesitate to conduct a formal test of cointegration given the short time span of the data.

sign in that a positive surprise leads to an upward adjustment of the private sector's forecasts of inflation. And the coefficient on the oil price forecast variable is statistically significant, in contrast to Pedersen (2015). The inflation surprise coefficient also has the right sign but is not statistically significant. On the other hand, changes in the expected yen exchange rate do affect significantly inflation expectations: the coefficient suggests that a 10% depreciation of the yen exchange rate would be associated with a 0.4% increase in expected inflation. Further, the lagged variable is statistically significant. The adjusted R-squared for the expectations models without Bank of Japan forecasts is around 55%.[7]

In column (3), we include the main explanatory variable ($\pi^{boj}_{t-1,ny} - \pi^{esp}_{t-1,ny}$) and find it is statistically significant at the 1% level. Even after controlling for other information that might have influenced expectations between the two ESP forecasts, the private sector forecasters do indeed appear to take into account the degree to which recent Bank of Japan forecasts differ from their own previous forecasts when updating their own forecasts. The size of the coefficient on the variable suggests that on average for every 1% point increase in the differential between BOJ and ESP forecasts across periods, the private sector forecasters would raise their own forecast by around 0.17%. The adjusted R-squared increased from 55% to 67% when consideration is made of the Bank of Japan forecasts, as shown in column (3).

It is possible that the specification is incomplete due to shifts in the monetary policy regime. We thus extend the main regression equation by allowing for the impact of the central bank forecasts to change after the BOJ adopted inflation targeting. Column (4) reports the estimation results for the regression equation which adds an interaction term between the period dummy which is one when inflation targeting was in effect (ie starting from the ESP survey in February 2013), and the main explanatory variable.

The economic significance of the main explanatory variable increases, as the coefficient on the variable rises from around 0.17 to 0.26. Namely, the current specification suggests that

[7] In unreported specifications, we also included expected real GDP growth, but it had less explanatory power than other macroeconomic factors and had the wrong sign for current year forecasts, strongly suggesting that once other factors are controlled for, near-term inflation expectations have not been responsive to changes in real growth expectations in Japan. This may be related to the high volatility of actual GDP growth in Japan.

private forecasters increase their next-year forecast by 0.26% in response to a one percentage point increase in the difference between the BOJ forecast and ESP forecast.

At the same time, the sign of the coefficients for the added interaction terms suggest that the impact of the Bank of Japan forecasts has been muted somewhat since the introduction of the inflation targeting policy. The interaction term in column (4) is significantly negative, and its coefficient in absolute value is around 60% of the coefficient on the main explanatory variable. However, the economic and statistical significance of the interaction coefficients disappear once a dummy is included for the first announcement after the Lehman failure (column (5)), or the first observation after the Lehman failure is omitted from the sample (column (6)).

We next run similar regressions, but this time explaining the changes to the current year median forecasts of ESP surveys. As stated before, this exercise is only for supplementary purposes; not only are the current year forecasts subject to actual data (and their revisions) which are unrelated to forward looking expectations, but next-year forecasts also reflect the medium to long-term time horizon that is the greater concern of monetary policy-makers when it comes to inflation expectations.

Table 3 reports the estimation results. Many of the qualitative features of regression results for the next-year forecast are not greatly changed. The lag change in the ESP forecasts remains highly significant in columns (1)-(3). Expected exchange rate changes retain the expected sign with all specifications statistically significant. The regression coefficients on the control variables for inflation surprise and oil price still have the right sign, but are not statistically significant.

However, the impact of BOJ current year forecasts on private sector forecasts appears to have been reduced more than the case of next year forecasts (though not eliminated) since the onset of inflation targeting. The interaction term associated with the inflation targeting period is of the opposite sign in column (4), and the absolute value of the coefficient for the interaction term is around 80% that of the BOJ difference. And the IT interactive dummy remains statistically significant even when the first observation after the Lehman failure is controlled for (columns (5) and (6)). Thus, since 2013, private forecasters have tended to weigh less heavily the BOJ current year forecasts when revising their own forecasts.

Japan's limited experience with inflation targeting has for the most part coincided with quantitative and qualitative easing policies. A factor to keep in mind is that the private sector's forecasts for long-term inflation rates in Japan had been well below 2% for many years (Graph 3). The diminished responsiveness of private sector forecasts to BOJ forecasts, at least for the current year forecasts, may have reflected divergent views among private sector forecasters on the ability of measures to achieve the 2% inflation target from below, efforts which were in many respects unprecedented, while the Bank of Japan maintained confidence since the policy board had decided on the policy measures after a thorough internal discussion and debate.[8]

5. The relative accuracy of BOJ forecasts

That the Bank of Japan forecasts influence the private sector forecasts is a finding consistent with those of others including Fujiwara (2005) and more recently Hubert (2015). This influence could have been due to a prevailing view that the Bank of Japan forecasts were superior, in some sense based on a superior information set, than private sector forecasts. Such a superior information set could of course include inside knowledge about the future direction of policy, though it is worth noting that officially Bank of Japan forecasts are made with reference to the view of market participants regarding the future course of policy.[9]

During the pre-IT era, Bank of Japan forecast accuracy appears to be roughly similar to that of private sector economists – if anything slightly less accurate. Table 4 summarizes the mean errors and root-mean squared errors (RMSE) of the private sector forecasts and the

[8] In the words of Kuroda (2013), "[…] Japan faces a different type of challenge. In the United States and Europe, people's inflation expectations have been anchored around the central banks' targeted inflation rates. In Japan, amid some 15 years of deflation, deflationary expectations have become entrenched among people -- in other words, people's inflation expectations have been anchored at a substantially low level of around 0 percent. We need to de-anchor such expectations, increase them to the price stability target of 2 percent, and anchor the expectations again at this level."

[9] From Oct 2000-Oct 2005, Bank of Japan forecasts were based on assumption that there will be no change in monetary policy; from April 2006-January 2013, forecasts were in reference to the view of market participants regarding the future course of the policy rates, as incorporated in market interest rates. From April 2013-present, the forecasts were made assuming the effects of past policy decisions and with reference to views incorporated in financial markets regarding future policy.

Bank of Japan forecasts during both the 2004-2012 (pre IT) and 2013-2015 (IT) periods. During the 2004-2012 period the private sector forecast mean errors and RMSE were somewhat less than those of the BOJ current-year forecasts; however the differences are statistically insignificant. And as for next year forecasts, the ESP forecasts have lower mean error while the BOJ's have lower RMSE, but in both cases the differences are statistically insignificant.

Given the earlier results both in this paper and others that Bank of Japan forecasts influence those of the private sector, what the above findings confirm is that the impact of the Bank of Japan forecasts need not be due to a strictly superior information set or forecasting technology than that of the private sector. Rather, information that the Bank of Japan conveyed via its forecasts could be viewed as complementary to that of the private sector, and thus have an impact on the margin.[10] In theory, the underperformance of a forecast in one dimension or absence of outperformance overall does not mean it cannot add marginal value to another forecast.

What about after the implementation of the inflation targeting policy? Though the private sector forecasts now have lower mean error and RMSE for both current and next year forecasts than those of the Bank of Japan, the differences are statistically significant only at the 10% levels for the mean error of the next-year forecasts; other differences are statistically insignificant.

Based on the accuracy metrics, it is not clear that inflation became either easier or more difficult to predict during the inflation targeting era. For the ESP current-year forecasts, while the mean error has declined, the RMSE has edged up; for next-year forecasts, the mean forecast error has risen while the RMSE has declined.

6. Event Study Evidence

It is worth checking whether event study evidence - ie behaviour of Bank of Japan and private sector forecasts around significant events - is consistent with the regression results.

[10] Yet another possibility more in line with a behavioral economics explanation is that private forecasters may shade their forecasts to maintain some consistency with Bank of Japan forecasts regardless of their information value.

We choose policy changes announced by the Bank between 2012 and 2013: the first two of these were prior to the adoption of inflation targeting, and the other one came afterwards.

In February 2012, the Bank of Japan introduced a price stability goal of 1%, but without the sort of time commitment promise that is normally associated with inflation targeting regime, which is why we do not classify this period as part of the IT regime. Yet, in the first forecasts announced by the Bank in later April after the introduction of the inflation goal, the median forecasts of the BOJ for fiscal years 2012 and 2013 were both lifted by 0.2 percentage points, from 0.1 to 0.3% for fiscal year 2012, and from 0.5 to 0.7% for 2013 (Graph 4, center panel). The fiscal year 2012 inflation forecasts of the private sector increased after the Bank of Japan revisions, from 0% in April, to 0.1% in May. (Graph 4, right panel). While the policy announcement likely had some influence, the fact that the realised inflation rate also turned positive in the first quarter of 2012 may also have had an effect on both forecasts (Graph 4, left panel).

In December 2012, Shinzo Abe, who advocated massive economic stimulus, was elected as Prime Minister. Roughly a month later, the Bank of Japan set a price stability target of 2% on 22 January 2013. It is from this period that we identify the start of the inflation targeting regime. At that time, the Bank of Japan did not change its forecast for fiscal year 2013, but raised the forecast for fiscal year 2014 slightly from 2.8% to 2.9% (inclusive of consumption tax hike). While the private sector inflation forecasts did not respond around the election of Abe, the forecast for fiscal year 2013 did rise modestly by 0.1% following the announcement of the inflation target. Despite falling realised inflation extending to early 2013, forecast for fiscal year 2013 rose from 0.1% before announcement of inflation targeting to 0.25% in April 2013, and from 2.4% to 2.5% for the fiscal year 2014 forecasts.

After the appointment of Bank of Japan Governor Kuroda, and the launch of an aggressive plan of monetary easing on 4 April 2013, the Bank of Japan raised their inflation forecasts substantially on 26 April 2013, with forecasts for fiscal year 2013 raised by 0.3 percentage points to 0.7%, and for fiscal year 2014 raised by 0.5% to 3.4%. The impact of the new program of QQE was not at all evident in the surveys either after the announcement of QQE or the new forecasts: in fact, private sector forecasts reacted rather slowly, with the fiscal year 2013 forecast rising minimally by 0.05% and the fiscal year 2014 forecast by 0.1% in May. The fiscal year 2013 forecast gradually edged up to 0.6% at the end of 2013 and further to 0.8% in early 2014 while the fiscal year 2014 forecasts hovered around 2.6%-2.7%

before moving to 3% in early 2014. It could be the case that rising realised inflation rates in the second half of 2013 gradually motivated the forecasters to rethink the effect of the QQE on inflation (Graph 4, left and right-hand panels).

To sum up this section, the event study analysis is consistent with the regression analysis in the sense that the private sector forecasts have generally been following Bank of Japan forecasts. This responsiveness has continued in the inflation targeting era, though it may have been somewhat limited during the early stages of the unprecedented QQE policy.

7. Robustness checks

In this section, we report the results of some robustness checks – ie running regressions with different combinations of variables – on some potential complications that may have accounted for the main findings that were reported in section 4. We also run the regressions using monthly instead of semi-annual/quarterly ESP forecasts. The results of all robustness checks are generally consistent with the earlier results.

Different Inflation Target or Goal Regimes

Our paper finds that although the adoption of inflation target in January 2013 appeared to modestly reduce the influence of BOJ forecasts, in the case of next year forecasts, this reduction was not robust to the elimination of the first observation after the Lehman failure. As alluded to briefly in section 3, nearly a year earlier in February 2012, the Bank of Japan had announced a less ambitious "inflation goal" without as explicit a commitment to achieve it. In addition, only three months after the adoption of inflation targeting, in April 2013, the Bank of Japan announced a new regime of monetary easing measures, known as QQE, with an explicit intent of achieving the inflation target within two years. It is possible that the identification of regime change is more properly considered broadly to include the inflation goal era from 2012, or alternatively, should only include the period after which an explicit 2-year time framework had been made explicit.

In a set of specifications reported in Table 5 (columns (1) and (2)), we check whether including an additional dummy for the inflation goal period of 2012 makes a big difference to the results for next year forecasts. The extended regression equation now includes two interaction terms rather than one; one between inflation goal period dummy and the main

explanatory variable and the other between inflation target period dummy and the main explanatory variable. The significance of the main explanatory variable holds as in the previous regressions. The coefficient on the additional inflation goal period interactive dummy while negative, and roughly the same value of the inflation target period interactive dummy, is statistically significant only in the case of regressions that include the first observation after the Lehman default. Once again, any reduced impact of Bank of Japan next-year forecasts is not robust to the exclusion of the first observation after the Lehman default. At the same time, a diminished impact is documented for current-year forecast regressions (not reported), consistent with previous regressions.

The impact of inflation volatility

When economic and financial conditions dramatically change, the influence of any particular forecast by market and government players may also be affected given the increased uncertainty surrounding the forecasts. To control for the impact of periods of heightened volatility, we include a measure of core CPI volatility. The variable is not significant and the main findings hold for the next year forecasts (Table 5, columns (3) and (4)).

Excluding the consumption tax hike of 2014

In April 2014, during the period under investigation in this paper, the Japanese government implemented a consumption tax hike of 3% that had been legislated a few years earlier. The forecasts examined so far, both of the Bank of Japan, and the ESP forecasts, were inclusive of this tax increase.

However, both the Bank of Japan and the ESP also released forecasts of inflation that were net of the impact of the tax hike. The Bank of Japan and ESP gross and net forecasts might inherently reflect different assumptions about the impact of the tax hike. We check in Table 6 whether the earlier results are robust to the substitution of these net (rather than gross) forecasts in the definition of the dependent and explanatory variables. If anything, the results suggest that the impact of Bank of Japan forecasts on private sector forecast may actually be somewhat higher when forecasts net of the tax hike are considered (though the difference is too small to be statistically significant). At the same time, the qualitative results that the impact of Bank of Japan next year forecasts during the recent IT period has not significantly diminished, once the Lehman default is controlled for, remains intact.

Quarterly Dummies

Because forecasts made during different quarters have different horizons, it is possible there may be seasonal effects to the impact of Bank of Japan forecasts. We control for this possibility by interacting the main explanatory variable, the difference between the Bank of Japan and ESP forecasts, with quarterly dummies in specifications reported in Table 7. In none of the specifications are the quarterly dummies statistically significant.

Monthly Observations

Since ESP forecast observations are available on a monthly basis, it is possible to use monthly data to gain more precision in the estimate of the determinants of the change in private sector forecasts. On the other hand, because the BOJ forecasts are at a lower frequency than the rest of the sample, the estimate of the impact of the Bank of Japan forecasts may be misstated using monthly data.[11] With this caveat in mind, we examine the results for next year forecasts in Table 8, using monthly data. All specifications include a period dummy for December 2014 since a very large ESP forecast change in the month of -0.7% reflected the announced delay of consumption tax hike which was not yet reflected in the lower frequency BOJ forecasts.

For the next year forecasts, the impact of the main explanatory variable of interest, the difference between Bank of Japan and ESP forecasts, is similar in magnitude[12] and statistically significant. The signs of the control variable coefficients are unchanged, and generally the same variables that are statistically significant in the earlier regressions are also significant in the monthly regressions, though the overall explanatory power of the regression as measured by the adjusted R-squared has declined considerably.

However, the estimated impact of the IT period has changed somewhat. The interactive dummy on the inflation target period is now marginally significant in the final specification

[11] The main explanatory variable, the difference between the BOJ and ESP forecasts, is set to zero in the months between BOJ forecasts to reflect the view that no new information about the BOJ forecast is likely to be inferred from the difference in months without a forecast. An alternative treatment of the variable, where the difference is set to the difference between the last available BOJ forecast and the latest ESP forecast, yields qualitatively very similar results.

[12] For instance, a coefficient of approximately 0.18 in column 3 of Table 8 compares to 0.14 in column 6 of Table 2.

(at the 10% confidence level), meaning that the estimated impact of BOJ next-year forecasts has diminished somewhat (though not completely) in the recent period. However, given the much higher R-squared of the regressions that limit the private forecasts to those around the BOJ announcement, the results here are not sufficiently strong to draw into question the earlier findings.

8. Conclusion

This paper finds that the influence of the BOJ's forecasts on private sector's forecasts remains significant even if the BOJ forecasts do not strictly dominate a large group of private forecasters in terms of accuracy. Despite the potential for increased uncertainty after its introduction of inflation targeting, particularly in the early stages of the adoption of the new and unprecedented QQE monetary policy, the impact of the BOJ forecasts on those of the private sector has remained stable in the case of *next-year* forecasts.[13] By contrast, the impact appears to have diminished, though not completely, in the case of *current-year* forecasts.

This case study gives us insights into the relationship between inflationary expectations, central bank and private sector forecasts, as well as the impact of different monetary policy regimes, especially when the targeted inflation rate is higher than the expected inflation rate. We hope our findings here will stimulate further research on the impact of central bank forecasts under different policy regimes.

[13] In any case, the Bank of Japan (2015a, 2015b) reports that the households' expected inflation rate has risen by a range of around 1% to around 1.5% since introduction of the QQE.

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Bank of Japan's forecasts and ESP Forecasts

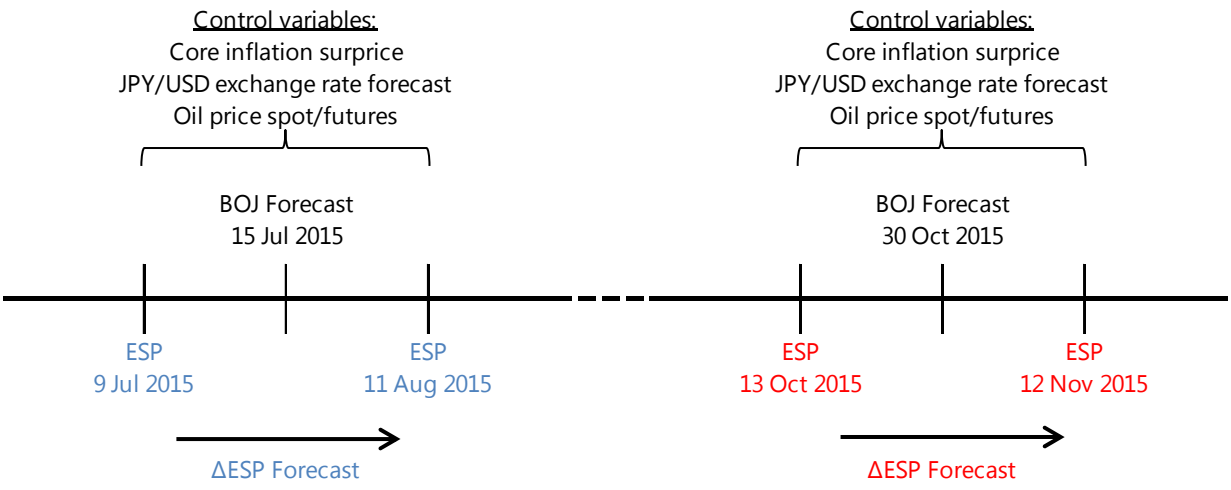
Table 1

	Bank of Japan's forecasts	Private sector's forecasts
Source	BOJ publications (eg "Outlook for Economic Activity and Prices", "Statement on Monetary Policy")	Japan Center for Economic Research ("ESP Forecast")
Frequency	October 2000–April 2008: Semi-annually. July 2008–Now: Quarterly	May 2004–Now: Monthly
Forecast variable	Annual core inflation (ie Headline inflation excluding fresh food)	Annual core inflation
Forecast horizon	Current and next fiscal years; two-year ahead forecasts from 2008 October	Current and next fiscal years; two-year ahead forecasts are available from time to time
Data level	Range and median of individual forecasts	Mean and median of individual forecasts; Individual forecasts are also available

Sources: Bank of Japan; Japan Center for Economic Research

Illustration of matching procedure and methodology

Graph 1

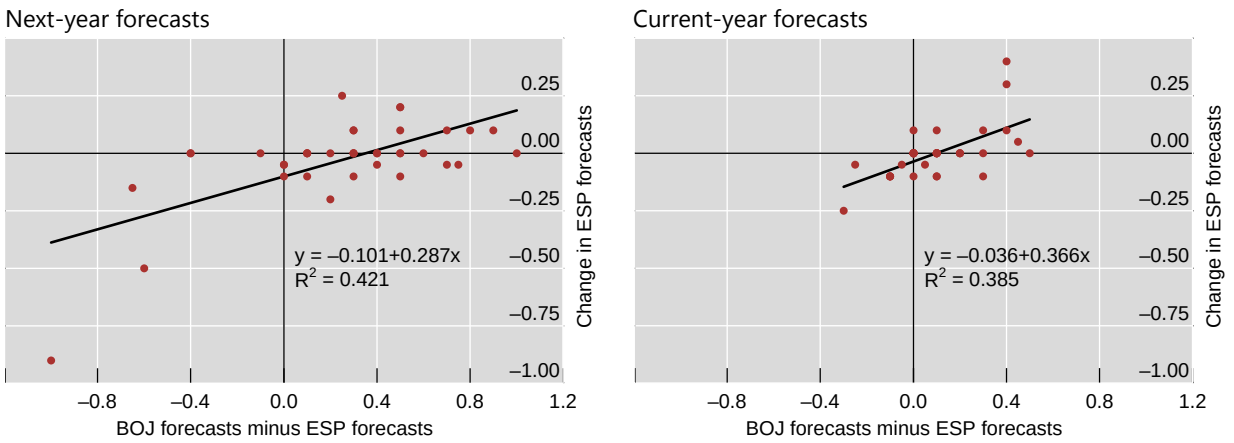


The dates under BOJ forecast and ESP indicate the date when the forecasts were published.

Responsiveness of ESP forecasts to the difference between BOJ forecasts and ESP forecasts in the previous survey[1]

In percentage points

Graph 2



[1] Changes in ESP forecasts refer to the changes in the median of forecasts of core inflation by private forecasters responding to the ESP surveys—one before the BOJ forecasts release and one after that. BOJ forecasts refer to the median of forecasts of core inflation by BOJ policy board members. The horizontal axis shows the between BOJ forecasts and the ESP forecasts in the survey prior to the release of BOJ forecasts.

Sources: Bank of Japan; Japan Center for Economic Research; authors' calculations.

Regression results: next-year forecasts

Table 2

	(1)	(2)	(3)	(4)	(5)	(6)
$Constant$	-0.0065	-0.0032	-0.0529 **	-0.0454 *	-0.0270	-0.0270
	(0.0189)	(0.0178)	(0.0244)	(0.0236)	(0.0194)	(0.0191)
$\Delta\pi_{t-1,ny}^{esp}$	0.7113 ***	0.6020 ***	0.4402 **	0.3064	0.5525 ***	0.5525 ***
	(0.1776)	(0.1735)	(0.1668)	(0.1943)	(0.1827)	(0.1803)
$InfSurp_t$	0.1095	0.1120	0.1588	0.1871	0.1092	0.1092
	(0.3038)	(0.2665)	(0.2124)	(0.2256)	(0.1738)	(0.1715)
$\Delta e_{t,ny}^{esp}$	0.0425 *	0.0367 **	0.0239 **	0.0268 ***	0.0130 *	0.0130 *
	(0.0214)	(0.0144)	(0.0101)	(0.0089)	(0.0076)	(0.0075)
Δoil_t^{spot}	0.0050					
	(0.0034)					
Δoil_t^{ny}		0.0091 **	0.0077 **	0.0064 **	0.0026	0.0026
		(0.0041)	(0.0031)	(0.0029)	(0.0025)	(0.0024)
$\pi_{t-1,ny}^{boj} - \pi_{t-1,ny}^{esp}$			0.1693 ***	0.2564 ***	0.1358 **	0.1358 **
			(0.0493)	(0.0750)	(0.0627)	(0.0619)
$(\pi_{t-1,ny}^{boj} - \pi_{t-1,ny}^{esp}) \times DumIT$				-0.1600 *	-0.0552	-0.0552
				(0.0798)	(0.0686)	(0.0677)
$(\pi_{t-1,ny}^{boj} - \pi_{t-1,ny}^{esp}) \times DumLehman$					0.5633 ***	
					(0.1217)	
Obs	38	38	38	38	38	37
R^2	0.4950	0.6013	0.7129	0.7454	0.8316	0.6005
$Adjusted\ R^2$	0.4337	0.5530	0.6680	0.6962	0.7924	0.5206

Equation (6) excludes the first observation after Lehman Brothers' bankruptcy.

Figures in bracket indicate standard errors. ***, ** and * indicate significance levels at 1%, 5% and 10% respectively.

Regression results: Current-year forecasts

Table 3

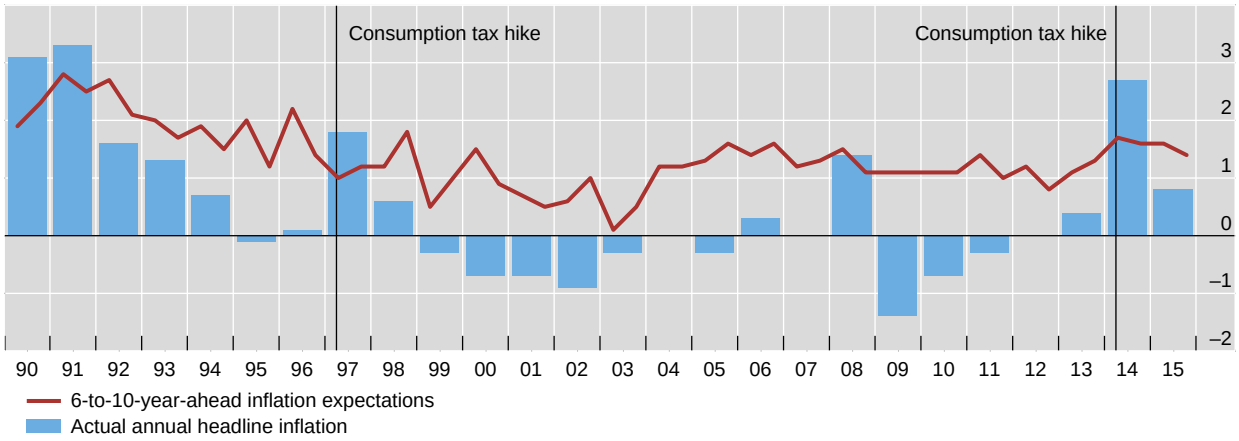
	(1)	(2)	(3)	(4)	(5)	(6)
$Constant$	-0.0035	-0.0025	-0.0256 **	-0.0263 **	-0.0270 **	-0.0270 **
	(0.0129)	(0.0129)	(0.0116)	(0.0117)	(0.0126)	(0.0124)
$\Delta\pi^{esp}_{t-1,cy}$	0.7965 ***	0.7896 ***	0.5256 **	0.2571	0.2475	0.2475
	(0.2778)	(0.2805)	(0.2542)	(0.2190)	(0.2281)	(0.2250)
$InfSurp_t$	0.0415	0.0590	0.1672	0.2176	0.2202	0.2202
	(0.1992)	(0.2036)	(0.1586)	(0.1441)	(0.1484)	(0.1464)
$\Delta e^{esp}_{t,cy}$	0.0258 **	0.0268 ***	0.0164 *	0.0170 **	0.0181 **	0.0181 **
	(0.0097)	(0.0096)	(0.0084)	(0.0064)	(0.0085)	(0.0084)
Δoil^{spot}_t	0.0014					
	(0.0014)					
Δoil^{cy}_t		0.0031	0.0022	0.0019	0.0021	0.0021
		(0.0028)	(0.0027)	(0.0021)	(0.0024)	(0.0024)
$\pi^{boj}_{t-1,cy} - \pi^{esp}_{t-1,cy}$			0.2292 ***	0.4439 ***	0.4564 ***	0.4564 ***
			(0.0645)	(0.0871)	(0.1133)	(0.1118)
$(\pi^{boj}_{t-1,cy} - \pi^{esp}_{t-1,cy}) \times DumIT$				-0.3661 ***	-0.3798 ***	-0.3798 ***
				(0.0962)	(0.1285)	(0.1268)
$(\pi^{boj}_{t-1,cy} - \pi^{esp}_{t-1,cy}) \times DumLehman$					-0.0717	
					(0.2408)	
Obs	38	38	38	38	38	37
R^2	0.5098	0.5148	0.6261	0.7121	0.7126	0.6644
$Adjusted\ R^2$	0.4504	0.4560	0.5677	0.6564	0.6455	0.5973

Equation (6) excludes the first observation after Lehman Brothers' bankruptcy.

Figures in bracket indicate standard errors. ***, ** and * indicate significance levels at 1%, 5% and 10% respectively.

Realised and long-term inflation expectation

Consensus forecasts; calendar year; in per cent — Graph 3



The vertical lines indicate consumption tax hikes: from 3% to 5% in April 1997; from 5% to 8% in April 2014.

Sources: Statistics Bureau of Japan; Consensus Economics ©.

Forecast accuracy[1]

In percentage points — Table 4

	2004–2015		Of which: Before inflation targeting		Inflation targeting period[3]	
	BOJ	ESP	BOJ	ESP	BOJ	ESP
Mean forecast errors[2]						
Current year	0.1579	0.0632	0.1259	0.0648	0.2364	0.0591
Next year	0.4771	0.2643	0.3000	0.2148	1.0750	0.4313*
Root mean squared errors (RMSE)[2]						
Current year	0.3246	0.2833	0.3091	0.2713	0.4134	0.3108
Next year	0.9759	0.8732	0.8842	0.9099	1.2359	0.7359

[1] Compare BOJ forecasts and ESP forecasts in the survey right before the release of BOJ forecasts. [2] Forecast errors are calculated by subtracting realised inflation rate from forecasts, ie a positive forecast error indicates the realised inflation rate is smaller than the forecast. Sample includes forecasts made in 2004–2015, excluding the forecasts for fiscal year 2016. [3] The sample for BOJ forecasts starts from 26 April 2013 while that for ESP forecasts starts from survey closed on 3 April 2013.

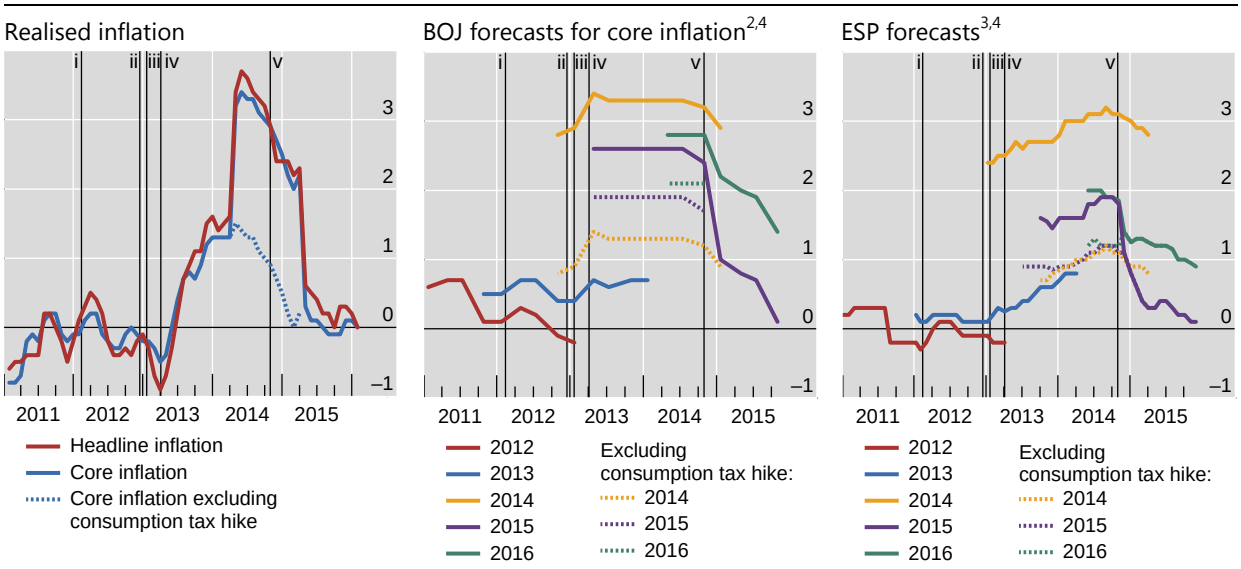
* indicates the difference between BOJ forecast and ESP forecast is significant at 10% level (t-test)

Sources: Bank of Japan; authors' calculations.

Realised inflation and core inflation forecasts[1]

In per cent

Graph 4



[1] Vertical lines indicate important events: (i) 14 February 2012: Inflation goal of 1% was introduced; (ii) 16 December 2012: Shinzo Abe was elected the Prime Minister; (iii) 22 January 2013: Inflation target of 2% was adopted; (iv) 4 April 2013: Quantitative and qualitative easing programme was launched (QQE1); and (v) 31 October 2014: Quantitative and qualitative easing programme was expanded (QQE2). [2] Horizontal axis indicates forecast dates. Each line represents the fiscal year being forecasted. Forecasts were made quarterly in January, April, July and October. [3] Horizontal axis indicates the dates when the ESP survey closed. Each line represents the calendar year being forecasted. Forecasts were made monthly. [4] Consumption tax hike scheduled for October 2015 has been postponed to April 2017, a proposal by the Abe's administration in November 2014. Reflecting this postponement, the forecasts by the BOJ in 2015 and by the ESP since December 2014 for fiscal years 2015 and 2016 do not entail consumption tax hike, resulting in remarkable declines of core inflation forecasts (purple and green lines in the centre and right panels).

Sources: Bank of Japan; Statistics Bureau of Japan; Japan Center for Economic Research; authors' calculations.

Robustness check: Next-year forecasts, with inflation goal period and inflation volatility

Table 5

	(1)	(2)	(3)	(4)
$Constant$	-0.0389	-0.0226	-0.0491	-0.0409
	(0.0247)	(0.0203)	(0.0315)	(0.0247)
$\Delta\pi_{t-1,ny}^{esp}$	0.3143	0.5526 ***	0.3122	0.5855 ***
	(0.1973)	(0.1822)	(0.1998)	(0.1656)
$InfSurp_t$	0.1563	0.0878	0.1812	0.0824
	(0.2038)	(0.1501)	(0.2410)	(0.1866)
$\Delta e_{t,ny}^{esp}$	0.0264 ***	0.0130	0.0264 **	0.0107
	(0.0088)	(0.0077)	(0.0100)	(0.0074)
Δoil_t^{ny}	0.0061 **	0.0025	0.0064 **	0.0025
	(0.0029)	(0.0024)	(0.0029)	(0.0024)
$\pi_{t-1,ny}^{boj} - \pi_{t-1,ny}^{esp}$	0.2836 ***	0.1592 **	0.2820 *	0.2338 *
	(0.0799)	(0.0648)	(0.1497)	(0.1265)
$(\pi_{t-1,ny}^{boj} - \pi_{t-1,ny}^{esp}) \times DumIT$	-0.1961 **	-0.0849	-0.1661 **	-0.0755
	(0.0863)	(0.0726)	(0.0788)	(0.0736)
$(\pi_{t-1,ny}^{boj} - \pi_{t-1,ny}^{esp}) \times DumIG$	-0.1802 **	-0.1359		
	(0.0835)	(0.0820)		
$(\pi_{t-1,ny}^{boj} - \pi_{t-1,ny}^{esp}) \times InfVol_t$			-0.0361	-0.1447
			(0.2196)	(0.1580)
Obs	38	37	38	37
R^2	0.7563	0.6150	0.7457	0.6114
$Adjusted\ R^2$	0.6994	0.5220	0.6864	0.5176

Equations (2) and (4) exclude the first observation after Lehman Brothers' bankruptcy.

Figures in bracket indicate standard errors. ***, ** and * indicate significance levels at 1%, 5% and 10% respectively.

Robustness check: Next-year forecasts, excluding consumption tax hike

Table 6

	(1)	(2)	(3)	(4)
$Constant$	-0.0059	-0.0565 **	-0.0483 *	-0.0300
	(0.0175)	(0.0244)	(0.0238)	(0.0193)
$\Delta\pi^{esp}_{t-1,ny}$	0.5839 ***	0.4038 **	0.2669	0.5059 ***
	(0.1669)	(0.1667)	(0.1862)	(0.1736)
$InfSurp_t$	0.0971	0.1501	0.1749	0.1040
	(0.2604)	(0.2106)	(0.2243)	(0.1678)
$\Delta e^{esp}_{t,ny}$	0.0366 **	0.0235 **	0.0266 ***	0.0132 *
	(0.0143)	(0.0098)	(0.0086)	(0.0072)
Δoil^{ny}_t	0.0090 **	0.0076 **	0.0062 **	0.0025
	(0.0041)	(0.0031)	(0.0028)	(0.0024)
$\pi^{boj}_{t-1,ny} - \pi^{esp}_{t-1,ny}$		0.1734 ***	0.2651 ***	0.1464 **
		(0.0492)	(0.0750)	(0.0615)
$(\pi^{boj}_{t-1,ny} - \pi^{esp}_{t-1,ny}) \times DumIT$			-0.1707 **	-0.0693
			(0.0763)	(0.0623)
Obs	38	38	38	37
R^2	0.5976	0.7149	0.7528	0.6035
$Adjusted\ R^2$	0.5488	0.6704	0.7050	0.5242

Equation (4) excludes the first observation after Lehman Brothers' bankruptcy.

Figures in bracket indicate standard errors. ***, ** and * indicate significance levels at 1%, 5% and 10% respectively.

Robustness check: Next-year forecasts, with quarterly dummies

Table 7

	(1)	(2)	(3)	(4)
$Constant$	-0.0495 *	-0.0242	-0.0429	-0.0234
	(0.0252)	(0.0179)	(0.0253)	(0.0185)
$\Delta\pi_{t-1,ny}^{esp}$	0.4992 ***	0.5889 ***	0.3722 *	0.5458 ***
	(0.1725)	(0.1550)	(0.1862)	(0.1843)
$InfSurp_t$	0.0543	0.0535	0.1027	0.0683
	(0.2274)	(0.1796)	(0.2497)	(0.1963)
$\Delta e_{t,ny}^{esp}$	0.0234 **	0.0091	0.0271 ***	0.0109
	(0.0092)	(0.0070)	(0.0092)	(0.0078)
Δoil_t^{ny}	0.0077 **	0.0016	0.0067 **	0.0016
	(0.0031)	(0.0024)	(0.0029)	(0.0024)
$\pi_{t-1,ny}^{boj} - \pi_{t-1,ny}^{esp}$	0.1030 **	0.0849 *	0.1965 **	0.1144
	(0.0492)	(0.0473)	(0.0746)	(0.0803)
$(\pi_{t-1,ny}^{boj} - \pi_{t-1,ny}^{esp}) \times DumIT$			-0.1481 *	-0.0453
			(0.0823)	(0.0744)
$(\pi_{t-1,ny}^{boj} - \pi_{t-1,ny}^{esp}) \times DumQ2$	0.1067	0.0424	0.1034	0.0444
	(0.0700)	(0.0703)	(0.0763)	(0.0716)
$(\pi_{t-1,ny}^{boj} - \pi_{t-1,ny}^{esp}) \times DumQ3$	0.1276	-0.1122	0.0829	-0.1146
	(0.1118)	(0.0813)	(0.0960)	(0.0838)
$(\pi_{t-1,ny}^{boj} - \pi_{t-1,ny}^{esp}) \times DumQ4$	0.0567	0.1404	0.0298	0.1283
	(0.1081)	(0.0939)	(0.1264)	(0.1055)
Obs	38	37	38	37
R^2	0.7317	0.6547	0.7576	0.6598
$Adjusted\ R^2$	0.6576	0.5560	0.6797	0.5464

Equations (2) and (4) exclude the first observation after Lehman Brothers' bankruptcy.

Quarterly dummies are defined with respect to fiscal year, ie Q2 refers to the period July to September, for example.

Figures in bracket indicate standard errors. ***, ** and * indicate significance levels at 1%, 5% and 10% respectively.

Robustness check: Next-year forecasts, monthly regression

Table 8

	(1)		(2)		(3)	
$Constant$	-0.0310	***	-0.0272	***	-0.0197	**
	(0.0116)		(0.0100)		(0.0096)	
$\Delta\pi^{esp}_{t-1,ny}$	0.1916	*	0.1712	*	0.2415	***
	(0.1083)		(0.0993)		(0.0921)	
$InfSurp_t$	0.1046		0.0929		0.0896	
	(0.0723)		(0.0695)		(0.0660)	
$\Delta e^{esp}_{t,ny}$	0.0190	**	0.0196	**	0.0138	*
	(0.0081)		(0.0076)		(0.0077)	
Δoil^{ny}_t	0.0043	**	0.0036	**	0.0020	
	(0.0021)		(0.0017)		(0.0015)	
$\pi^{boj}_{t-1,ny} - \pi^{esp}_{t-1,ny}$	0.1729	***	0.3031	***	0.1782	***
	(0.0573)		(0.0882)		(0.0588)	
$\left(\pi^{boj}_{t-1,ny} - \pi^{esp}_{t-1,ny}\right) \times DumIT$			-0.2346	**	-0.1172	*
			(0.0907)		(0.0654)	
$\left(\pi^{boj}_{t-1,ny} - \pi^{esp}_{t-1,ny}\right) \times DumTaxDelay$	-0.6872	***	-0.7072	***	-0.6986	***
	(0.0469)		(0.0471)		(0.0490)	
Obs	138		138		136	
R^2	0.4869		0.5269		0.4420	
$Adjusted\ R^2$	0.4634		0.5014		0.4115	

Equations (3) excludes the first two observations after Lehman Brothers' bankruptcy.

Figures in bracket indicate standard errors. ***, ** and * indicate significance levels at 1%, 5% and 10% respectively.

Variable description Appendix Table A1

Variable	Variable description	Sources
$\pi_{t,ny}^{esp}$ $(\pi_{t,cy}^{esp})$	ESP inflation forecast at time t for next (current) year, in percent	JCER
$\pi_{t,ny}^{boj}$ $(\pi_{t,cy}^{boj})$	The latest BOJ inflation forecast for next (current) year known to ESP survey respondents when they make forecasts at time t, in percent	BOJ
$\Delta\pi_{t,ny}^{esp}$ $(\Delta\pi_{t,cy}^{esp})$	Change in ESP inflation forecast between time t-1 and t for next (current) year, in percentage points	JCER; authors' calculations
$\pi_{t-1,ny}^{boj} - \pi_{t-1,ny}^{esp}$ $(\pi_{t-1,cy}^{boj} - \pi_{t-1,cy}^{esp})$	The latest BOJ inflation forecast for next (current) year known to ESP survey respondents when they make forecasts at time t minus ESP inflation forecast for next (current) year at time t-1	JCER; BOJ; authors' calculations
$\Delta e_{t,ny}^{esp}$ $(\Delta e_{t,cy}^{esp})$	Log change in ESP JPY/USD exchange rate forecast between time t-1 and t for next (current) year, in percent. A positive change indicates depreciation of JPY is expected.	JCER; authors' calculations
Δoil_t^{spot}	Log change in spot WTI oil price between time t-1 and t, in percent	Bloomberg; authors' calculations
Δoil_t^{ny}	Log change in the average of prices of WTI oil futures with deliveries in next fiscal year, between time t-1 and t, in percent. Namely, the log change in the average of future prices of contracts to be delivered in each month of the next fiscal year., The average of future prices is calculated as [F(Apr)+F(May)+…+F(Feb)+ F(Mar)]/12, where F(.) represents the future price of contract to be delivered in a particular month.	Bloomberg; authors' calculations
Δoil_t^{cy}	Log change in the weighted average (by approximate number of days of current fiscal year elapsed) of spot oil price and average of prices of WTI oil futures with deliveries in current fiscal year, between time t-1 and t, in percent. For example, if it is July, the weighted average is [F(Aug)*30+F(Sep)*30+…+F(Feb)*30+ F(Mar)*30+(365-30*8) x realised spot price since 1 Apr]/365, where F(.) represents the future price of contract to be delivered in a particular month	Bloomberg; authors' calculations
$InfSurp_t$	Core inflation surprise known at time t, defined as realised quarterly inflation at time t minus quarterly inflation forecasted prior to the release of realised figures, in percent.	Statistics Bureau of Japan; JCER; authors' calculations

Variable description (Cont'd) Appendix Table A1

Variable	Variable description	Sources
$InfVol_t$	Standard deviation of 12-month core inflation known at time t, in percentage points	Statistics Bureau of Japan; JCER; authors' calculations
$DumIT$	Dummy variable for inflation target period, equal to 1 for ESP surveys from February 2013 onwards, 0 otherwise	
$DumIG$	Dummy variable for inflation goal period, equal to 1 for ESP surveys from March 2012 to January 2013, 0 otherwise	
$DumLehman$	Dummy variable for Lehman Brothers bankruptcy, equal to 1 for ESP surveys in October and November 2008, 0 otherwise	
$DumQ2$	Quarterly dummy variable, equal to 1 for ESP surveys in July, August and September, 0 otherwise	
$DumQ3$	Quarterly dummy variable, equal to 1 for ESP surveys in October, November and December, 0 otherwise.	
$DumQ4$	Quarterly dummy variable, equal to 1 for ESP surveys in January, February and March.	
$DumTaxDelay$	Dummy variable to control for delay of consumption tax hike, equal to 1 for ESP surveys December 2014, 0 otherwise.	